Space Weather Technical Forecast

Issued on Sunday, 14 November 2021 at 12:13 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of G1/Minor Storm on Day 4 (17th).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar Activity was Very Low, with no notable flares in the last 24 hours. There are two small and simple sunspot regions on the Earth-facing disc. AR2894 Hsx/alpha in the southwest remains a simple mature and stable sunspot. A further small unnumbered Hsx/alpha region has rotated over the southeast limb and onto the Earth-facing disc. No Earth-directed CMEs were observed.

Solar Wind / Geomagnetic Activity: The solar wind speed, as measured at L1 by DSCOVR, was at background, easing from 370 km/s to 310 km/s. Density rose from below average to just above average by 14/1200. The interplanetary magnetic field (IMF) strength, Bt, was weak, remaining below 6 nT, with the north-south component, Bz, varying weakly between +/-4 nT. The phi angle was predominantly negative (towards the Sun). Geomagnetic activity remained Quiet (Kp 0-1).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured by GOES-16, remained at Background levels. The high energy electron flux (greater than 2 MeV) was mainly Moderate, but briefly High between 13/2020-2105 UTC peaking 1140 pfu. The associated 24-hour integrated fluence remained below the Active threshold (1e8 integrated pfu), on a slowly rising trend, with 5.64e7 integrated pfu recorded at 14/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be Very Low to Low, with a slight chance of C-class flares.

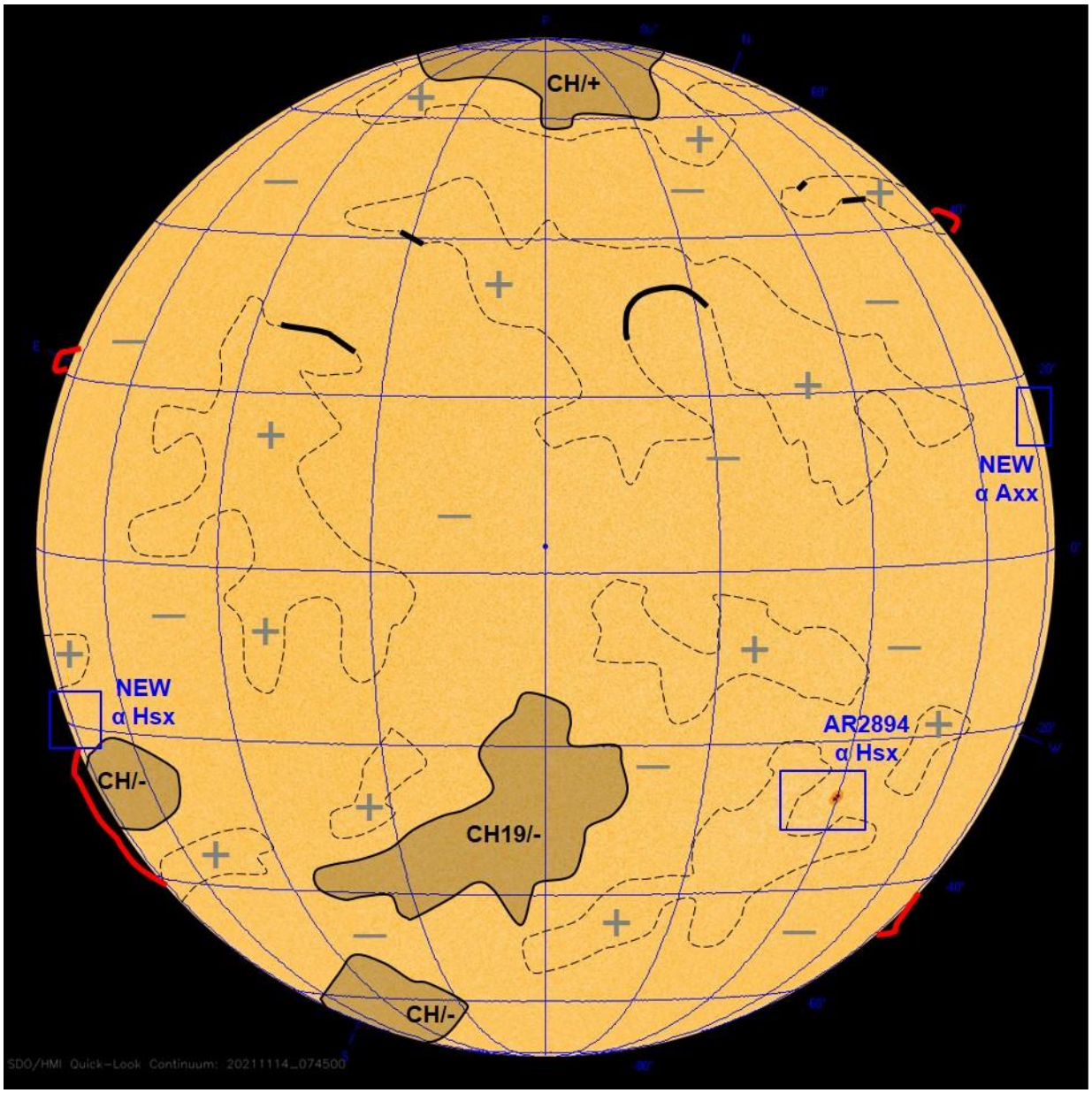
Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs. Background solar winds days 1-3 (14th-16th) are forecast to become elevated day 4 (17th) due to the arrival of the fast wind from coronal hole 19. Geomagnetic activity is expected to be mostly Quiet, perhaps Unsettled at times, before increasing to Unsettled to Active day 4 (17th) with a chance of G1/Minor Storm intervals.

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to be background. The high energy electron flux (greater than 2 MeV) is expected to continue at moderate, perhaps briefly high levels, but likely slowly declining, before potentially rising again late on day 4(17th). The corresponding 24-hour electron fluence is expected to remain below the Active level (1e8 integrated pfu).

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2021. All Rights Reserved.

Figure 1. Solar Analysis Valid 14/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2021. All Rights Reserved.

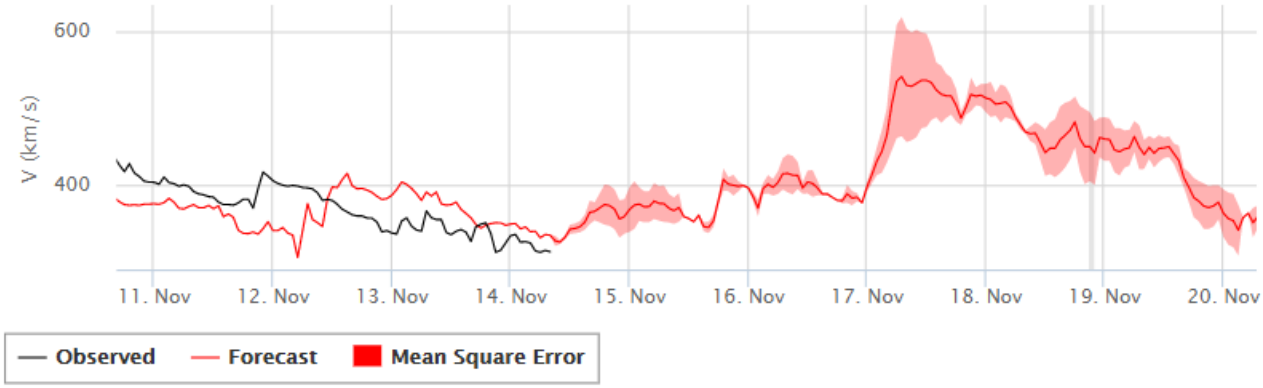
Geomagnetic Storms:

There are no Earth-directed CMEs. Solar wind speeds are currently at background, with no notable enhancement expected days 1-3 (14th-16th), before the arrival of the fast wind from the southern hemisphere negative polarity coronal hole 19, most probably day 4 (17th). This feature was present on the previous rotation, but appears to be both smaller and to have retrogressed eastwards, likely indicating a latter arrival than 27-day persistence would suggest. This signal is further complicated by a northern hemisphere coronal hole on the previous rotation which is not present on this occasion.

Geomagnetic activity is expected to be mostly Quiet, with a slight chance of isolated Unsettled intervals, but increasing day 4 (17th) to be Unsettled to Active with a chance of G1/Minor Storm intervals.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	5	30
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: Solar Wind Persistence Model



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2021. All Rights Reserved.

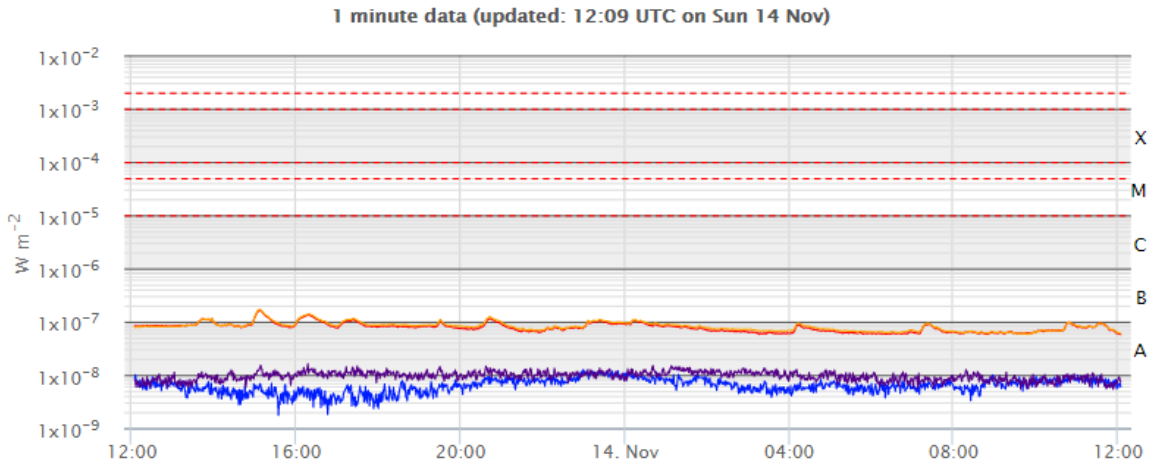
Radio Blackouts - X-Ray Flares:

Solar Activity is currently Low, with only two small and simple sunspot containing active regions. AR2894 in the southwest, which is a simple Hsx/alpha region and

Solar activity is anticipated to remain Very Low to Low, with a slight chance of further C-flares.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	1	1	1	1
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: GOES-16/17 X-ray Flux



Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as measured by GOES-16, remained at Background during the previous 24 hours, and is currently forecast to remain at this level through the period.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2021. All Rights Reserved.

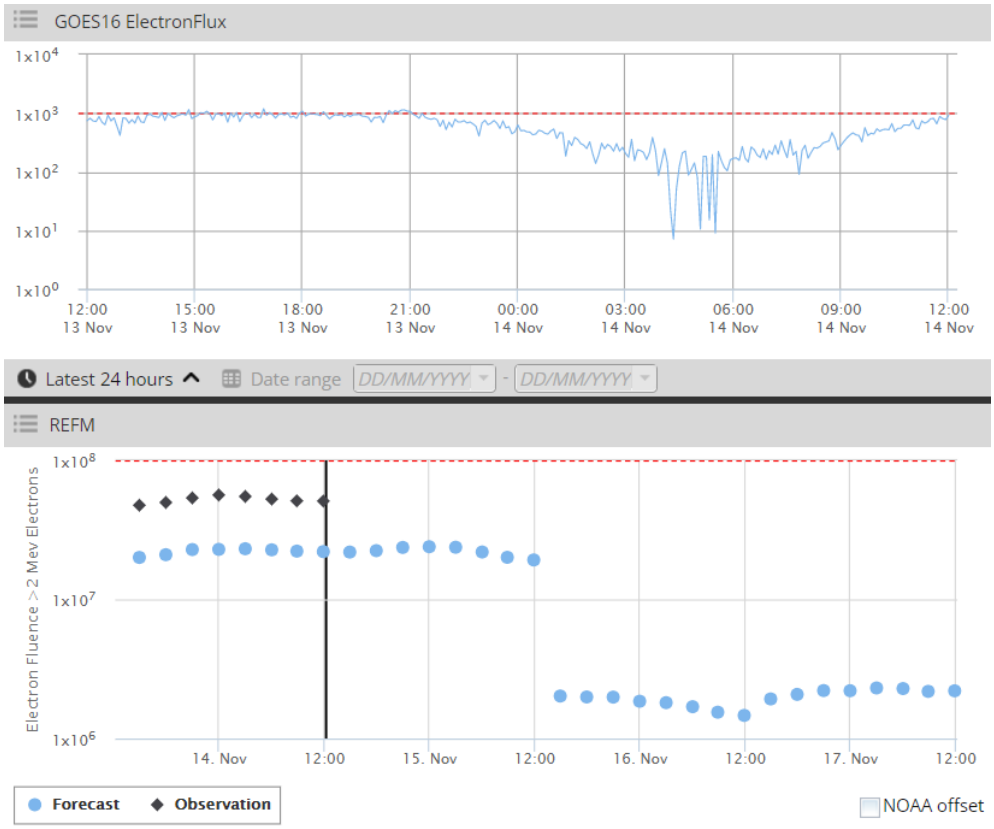
High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2 MeV) as measured by GOES-16 at GEO is currently at moderate levels with brief peaks of high (above 1000 pfu) on the 13th. These levels are likely to continue with peak values only erratically declining during days 1-3 (14th-16th). On day 4 (17th) the arrival of the fast wind from CH19/- is likely to bring some charging of the radiation belts, with flux levels potentially rising by the end of the day.

The associated 24-hour electron fluence is likely to remain below the Active (1e8 integrated pfu) threshold, with a gradual declining trend. REFM is currently giving good guidance. Any increase in the fluence levels due to CH19/- is expected after day 4 (17th).

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	5
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: GOES16 >2MeV Electron Flux and associated Fluence with REFM



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2021. All Rights Reserved.